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LXXIV. *A short Dissertation on Maps and Charts: In a Letter to the Rev. Thomas Birch, D. D. and Secret. R. S. By Mr. Wm. Mountaine, F. R. S.*

S I R,

London, March 21. 1758.

Read April 6.
1758.

AMONG the several improvements made in arts and sciences by ingenious men, the construction of *globes, maps, or charts*, deserves a place: not only on account of the pleasure and satisfaction that arises to speculative minds, in surveying the extent and divisions of this terraqueous globe, but also for their real use and service to navigation, trade, and commerce.

Globes perhaps were first invented, as bearing the nearest semblance to the natural form of the earth and sea, with proper circles thereon described, and the several empires and kingdoms, according to their extent, latitudes, and longitudes, as far as geography and history would admit.

But tho' these convey the most general and truest ideas of the position and situation of places; yet, as containing but a small surface, they were found not extensive enough to take in particular kingdoms or states, with their subdivisions, cities, and rivers, so as to convey an adequate and sufficient representation. Besides, they were not so portable and commodious in voyages or travels.

Maps and Charts were therefore thought of, as being most convenient for both the purposes above-

mentioned ; the accuracy of which depends on representing the meridians and parallels in such manner, that when places are laid thereon, according to their latitudes and longitudes, they may have such respect to each other, as they have on the globe itself ; and those are either *globular* or *rectilinear*.

Globular, or *curvilinear*, are either general or particular.

General, are the hemispheres ; for the most part constructed stereographically.

Particular, contain only some part of the terraqueous globe ; and of this sort there are sundry modes of construction, which for the most part are defective, so as not to be applied with accuracy and facility to the purposes intended, in determining the courses or bearings of places, their distances, or both.

Rectilinear were therefore very early adopted, on which the meridians were described parallel to each other, and the degrees of latitude and longitude everywhere equal ; the rumbs were consequently right lines ; and hereby it was thought, that the courses or bearings of places would be more easily determined.

But these were found also insufficient and erroneous, the meridians being parallel, which ought to converge ; and no method or device used to accommodate that parallelism.

Notwithstanding the great deficiency in this plane map or chart, it was preferred, especially in nautical business ; and hath its uses at this day in topographic constructions, as in bays, harbours, and very narrow zones.

However,

However, the errors herein were sooner discovered than corrected, both by mathematicians and mariners, as by Martin Cortese, Petrus Nonius, Coignet, and some say by Ptolemy himself.

The first step towards the improvement of this chart was made by Gerardus Mercator, who published a map about the year 1550, wherein the degrees of latitude were increased from the equator towards each pole ; but upon what principles this was constructed, he did not exhibit.

About the year 1590, Mr. Edward Wright, an Englishman, discovered the true principles upon which such a chart should be constructed ; and communicated the same to one Jodocus Hondius, an engraver, who, contrary to his honest faith and engagement, published the same as his own invention : This occasioned Mr. Wright, in the year 1599, to exhibit his method of construction, in his book, intitled, *Correction of Errors in Navigation*; in the preface of which book may be seen his charge and proof against Hondius ; and also how far Mercator has any right to share in the honour due for this great improvement in geography and navigation.

Blundevill, in his Exercises, page 327, published anno 1594, gives a table of meridional parts answering to even degrees, from 1° to 80° of latitude, with the sketch of a chart constructed therefrom ; but this table he acknowledgeth to have received from Mr. Wright, in the following words, page 326, viz. “ In the mean time to reform the faide faults,” (in the plane chart) “ Mercator hath in his universal “ chard or mappe made the spaces of the parallels “ of latitude to bee wider everie one than other “ from the equinoctial towards either of the poles,

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“ by

“ by what rule I know not, unless it be by such a
 “ table as my friend Maister Wright of Caius-col-
 “ lege in Cambridge at my request sent me (I thank
 “ him) not long since for that purpose, which table
 “ with his consent, I have plainlie set down,” &c.

About the year 1720, a globular chart was published, said to be constructed by Mr. Henry Wilson; the errors in which were obviated by Mr. Thomas Hafelden, in a letter to Dr. Halley; who at the same time exhibited a new scale, whereby distances on a given course may be measured, or laid off, at one extent of the compasses, on Wright's projection; and was intended to render the same as easy in practice as the plane chart.

The above chart was published in opposition to Mr. Wright's, which that author charged with imperfections and errors, and that it represented places bigger than they are upon the globe.

It is true, the surface is apparently enlarged; but the position of places, in respect to one another, are in no wise distorted; and it may be asserted, with the same parity of reason, that the lines of sines, tangents, and secants, are false, because the degrees of the circle, which are equal among themselves, are thereupon represented unequal.

Yet if a map or chart was so constructed, as to shew the situation and true extent of countries, &c. *primâ facie* (if I may be allowed the expression), and yet retain all the properties, uses, and simplicity, of Wright's construction, it would be a truly great improvement; but this seems to be impossible.

The method exhibited by the Rev. Mr. Murdoch, in his paper, read before the Royal Society on the 9th of February last, shews the situation of places,
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and seems better calculated for determining superficial and linear measures, than any other that has occurred to me.

This Gentleman illustrates his theory with examples justly intended to point out the quantity of error, that will happen in a large extent.

For instance; Between latitudes 10° and 60° N. and containing 110 degrees difference of longitude, Mr. Murdoch computes the distance at 5594 miles; which, upon the arc of a great circle, is found to be 5477, or by other methods 5462; so that the difference is only 117, or at most 132 miles in so great an extent, and to an high latitude; and the higher the latitude the greater the error is like to be, wherever middle latitude is concerned.

His courses also agree very nearly with computations made from the tables of meridional parts.

In example the first they are the very same:

In example the 2d they agree to half a minute:

In example the 3d they vary $1^{\circ} 4'$, on account of the high latitudes, which extend from 56° to 80° N.

However, I do not esteem this method so simple, easy, and concise, in the practice of navigation, as Mr. Wright's construction, especially in determining the bearings or courses from place to place: nor will it (I presume) admit of a zone containing both north and south latitude.

Of these inconveniences Mr. Murdoch seems to be extremely well acquainted, when he expresses himself in the following very candid and ingenuous terms, *viz.* "As to Wright's or Mercator's nautical chart, it does not here fall under our consideration: it is perfect in its kind; and will always be reckoned among the chief inventions of the
" last

“ last age. If it has been misunderstood or misapplied by geographers, they only are to blame.”— And again, at the end of his nautical examples, he concludes thus, *viz.* “ It is not meant, however, that it ought to take place of the easier and better computation by a table of meridional parts.”

I have the honour to be, with the greatest respect,

S I R,

The ROYAL SOCIETY's, and

Your most obedient Servant,

William Mountaine.

ADDENDA to Mr. Murdoch's Paper, N^o. LXXIII.

IF it is required “ to draw a map, in which the superficies of a given zone shall be equal to the zone on the sphere, while at the same time the projection from the center is strictly geometrical ;” Take Cx to CM as a geometrical mean between CM and Nn , is to the like mean between the cosine of the middle latitude, and twice the tangent of the semidifference of latitudes ; and project on the conic surface generated by xt . But here the degrees of latitude towards the middle will fall short of their just quantity, and at the extremities exceed it : which hurts the eye. Artists may use either rule : or, in most cases, they need only make Cx to CM as the arc ML is to its tangent, and finish the map ; either by a projection, or, as in the first method, by dividing that part of xt which is intercepted by the secants thro' L and l , into equal degrees of latitude.

Mr. Mountaine justly observes, “ that my rule does not admit of a zone containing N. and S. latitudes.” But the remedy is, to extend the lesser latitudes to an equality with the greater ; that the cone may be changed into a cylinder, and the rumbs into straight lines.